

REMARKS:

The international PCT procedure has been done without a patent agent and we relied upon Article 34 (PCT) which states under paragraph 2 alinea c that:

“(c) The applicant shall receive at least one written opinion from the International Preliminary Examining Authority unless such Authority considers that all of the following conditions are fulfilled:

- (i) the invention satisfies the criteria set forth in Article 33(1),*
- (ii) the international application complies with the requirements of this Treaty and the Regulations in so far as checked by that Authority,*
- (iii) no observations are intended to be made under Article 35(2), last sentence.”*

We never received said written opinion during the course of the Procedure Before the International Preliminary Examining Authority, and a final IPE report was sent to us with “criteria set forth in Article 33(1)” that were not satisfied by certain of the submitted claims as can be seen in the translated International Preliminary Report.

In order to remedy the above, we complained to the IPEA but as delay is exhausted, it had no effect.

Hence, we suggest proceeding from the International Preliminary Examination report basis for further specifying acceptable claims.

- *Initial claims are the translated into English article 19 claims of which amendments are specified above.*
- *The document from the “international preliminary Report on the patentability” administration (form PCT/IPEA/409 concerning the international request N° PCT/EP2005/051405 on August 3, 2006) is referred thereafter “Notification”.*

You will find below our arguments to facilitate the re-examination of the patentability of the international demand entered in US National stage:

According to the examiner, the nearest document of the state of the art is [D3]:

- *Julsgaard B., Kozhekin A., and Polzik E; S., « Experimental long-lived entanglement of two macroscopic objects », Nature, 413, 400-403,, (2001).*

Simplified summary of the [D3] method presented like anteriority in the “Notification”:

[D3] described a method to generate and measure the entanglement of two samples containing 10^{12} Cesium atoms. The steps of the method comprise:

- *The two samples in the form of gas are placed in cells of glass.*
- *Two beams of near infra-red light (852 nm and 894 nm, which is approximately 1.7 eV) having specific properties (but non-entangled) carry out an optical pumping to form coherent states of spin in each sample.*
- *A pulse of ad hoc infra-red light (about 1.7 eV) is sent through the two aligned samples; the author affirms to obtain an entanglement of the spins, between the two samples, which lasts more than 0.5 milliseconds (but less than 0.8 milliseconds).*

- A second pulse of ad hoc infra-red light is sent through the two samples whose spins are entangled; a measurement taken through a divider of polarized beam makes it possible to measure a differential current that is characteristic of the entanglement of the spins of the two samples.
- The whole of a cycle of entanglement of spins and measurement, lasts 2 milliseconds.

[D3] mentions that remote communications are possible owing to the fact that a beam of light crosses the two samples; however this implementation requires either the proximity of the two samples, or still the hypothetical use of an optical fiber connecting the two samples, which constitutes an intrinsic limitation.

Simplified summary of the method, the product and the use described in the international filling Nr. PCT/EP2005/051405 (this summary shall not be understood as a limitation to the invention described in the international filling):

- The two samples contain at least a kind of metastable nuclei (isomers).
- One irradiates by means of entangled gamma rays of a sufficient energy (for example 1.1 MeV) the samples together in order to excite the nuclei and to communicate the entanglement of the gamma rays to the nuclei.
- One separates the "entangled samples" in whole or part, neither equipment or beam being necessary between these samples.
- One stimulates one of the entangled samples with x-rays, which causes the de-excitation of this sample and the emission of gamma rays corresponding to selected isomer and the isomeric transition of de-excitation (for example 236 keV), and what also causes the de-excitation of the other sample and the emission of gamma rays corresponding to the selected isomer and to the isomeric transition of de-excitation.

This technique is used to transmit at least an information by means of the stimulation of an entangled sample and by the measurement of a gamma radiation on the other entangled sample.

In this technique, whole or part of the metastable nuclei are entangled at the time of the isomeric transition due to excitation. Entanglement is preserved as long as the transition from natural de-excitation did not occur, which makes it possible to use the samples over durations of several half-lives; for example in the case of Indium 115, the half-life is 4.48 hours, but for Hafnium 178 this duration reaches 31 years, which makes it possible to implement real applications of communication to any distance and without optical fiber.

Furthermore, this technique does not rely on "macroscopic" entanglement, but relies on quantum entanglement of a plurality of couples or tuples (more than two) of excited nuclei.

The problem of the invention which would have been submitted to the man skilled in the art may be expressed as follow: starting from the technique described in [D3], would he find a document or a teaching in the state of the art pertaining to his domain of competence leading to the invention without knowledge of the invention ? obviously no.

Concerning the point V of the "Notification":

1. Novelty of claims 1-3, 5, 13:

Point 1.2.

Novelty of the product according to claim 1:

The “notification” references the [D3] document: the interpretation of the concatenation of the quoted subparagraphs does not correspond to the content and the significance of document [D3]: The Cesium used is most probably Cesium 133 whose natural abundance is 100% and who is stable. [D3] mentions no metastable nuclei nor does it use this property. Indeed, the pulses of pumping, used for entanglement and measurement are of near infra-red wavelengths (approximately 1.7 eV); this energy level cannot cause the isomeric transition of excitation. The product consisting of the Cesium samples in [D3] is thus not included in the characterization of claim 1 of product: thus it does not constitute an anteriority.

Consequently the simple product characterized according to claim 1 is quite new.

Inventive activity associated to the invention the product according to claim 1:

No document of the state of the art suggested the possibility of entangling metastable nuclei. No document of the state of the art suggested a technique to produce entangled gamma photons, nor to transfer the entanglement from entangled gamma photons to metastable nuclei. The tuning of the techniques of preparation of the product according to claim 1 and the identification of the product, are the results of the interbreeding of several experimental searches and theoretical analyses over several years.

Consequently the simple product characterized according to claim 1 results really from inventive steps.

Point 1.3. The “notification” references the [D3] document within the framework of the no-novelty of independent claim 1 which is now considered new.

Claim 2 being dependant upon claim 1, it is thus new and inventive. It specifies complementary properties involving the duration of use of the product.

Claim 3 being dependant upon claim 1, it is thus new and inventive. It specifies complementary properties involving the physical or chemical forms of the product.

Point 1.4. The “notification” reference the [D3] document: however the summaries of the methods of preparations of the products described in [D3] and the international filling Nr. PCT/EP2005/051405 deeply defer: in [D3] the spins of the samples are initially put in coherence, then entangled using a pulse of non-entangled near infra-red photons. In our international filling, the samples containing at least a kind of metastable nuclei are excited by entangled gamma rays, the energy of such photons being several order of magnitude greater.

Consequently the manufacturing process of the simple product according to claim 1 which is claim 5 is quite new.

No document of the state of the art suggested the possibility of entangling metastable nuclei. No document of the state of the art suggested a technique to produce entangled gamma photons, nor to transfer the entanglement from entangled gamma photons to metastable nuclei. The tuning of the techniques of preparation of the product according

to claim 1, is the result of the interbreeding of several experimental searches and theoretical analyzes over several years.

Consequently the manufacturing process of the simple product according to claim 1 which is claim 5 results really from inventive steps.

1.5. The "notification" references the [D3] document: however the device described in claim 13 is especially adapted to the manufacturing of the complex product according to claim 12 by implementing the method according to claim 5, which is new and inventive. No document of the state of the art presented a device especially designed to implement the method of claim 5 to supports forming the complex product, these supports containing a plurality of sets of samples to be entangled, each the aforesaid sets forming a simple product according to claim 1.

Consequently the device for manufacturing the complex product according to claim 12 is quite new.

No document of the state of the art suggested the design of a device for manufacturing the complex product according to claim 12.

Consequently the device for manufacturing the complex product according to claim 12 results really from inventive steps.

2. The "notification" reference the [D2] and [D4] documents: however the quantum phenomenon of teleportation mentioned in these documents consists in its simplest version in the "transfer" of an incidental photon by interaction with an entangled photon. The other entangled photon then emits the "exact" copy of the preceding incidental photon. Moreover, for obtaining this "exact" copy, the use of a conventional mean of communication is required.

In the international filling Nr. PCT/EP2005/051405, de-excitation by means of X-rays causes a collapse of the common wave function in both entangled metastable nuclei without teleportation of a photon; This collapse causes the simultaneous emission of a gamma ray by the metastable nucleus locally de-excited by an X-ray photon and also of another gamma ray by the entangled metastable nucleus in the distant sample if the entangled nuclei are distributed on the two samples. Contrary to the phenomenon of teleportation, the distant gamma photon is of an energy completely different from the energy of incident X-ray photon of stimulation on the locally entangled metastable nuclei.

No document of the state of the art suggested the possibility of producing a gamma photon by remote de-excitation of an entangled metastable nucleus.

The tuning of this technique of communication by means of the product according to claim 1 is the result of the interbreeding of several experimental searches and theoretical analyzes over several years.

Consequently the use of the simple product according to claim 1 which is claim 7 results really from inventive steps.

3. We are agreeing with the Examiner on the novelty and the inventiveness concerning claims 4, 6, and 12.

4. We are agreeing with the Examiner on the novelty and the inventiveness concerning the claims 8-11, and 14-21.

Concerning item VIII:

The applicants are indeed ready for any independent verification of their work.

Analysis of the amendments of each claim as entered in the US National stage:

Wording has been improved compared to the Article 19 claims translation provided by the inventor, as the international preliminary opinion had shown that insufficiently specific terms in the claims may lead to a wrong assessment of the invention.

The description distinguishes the following steps:

- *The preparation of the product (which is done through irradiation with high energy gamma in order to excite nuclei to a metastable state referred to as "excitation"),*
- *and the step of use of the product (which is done by irradiation with X-rays or low energy gamma, which is referred to as "stimulation").*

Art. 19 claim 1 is amended for nat. stage entry as claim 1 (CURRENTLY AMENDED):

- *To introduce a non characterizing part*
- *Minor rewording is done*
- *Claim 1 is an independent claim of simple product.*

Article 19 claim 2 is amended for nat. stage entry as claim 2 (CURRENTLY AMENDED):

- *Minor rewording is done*
- *Terminology is adapted to claim 1 rewording*
- *Claim 2 is a dependent claim.*

Article 19 claim 3 is amended for nat. stage entry as claim 3 (CURRENTLY AMENDED):

- *Minor rewording is done*
- *Terminology is adapted to claim 1 rewording*
- *Claim 3 is a dependent claim.*

Art. 19 claim 4 is amended for nat. stage entry as claim 4 (CURRENTLY AMENDED):

- *Minor rewording is done*
- *Terminology is adapted to claim 1 rewording*
- *Claim 4 is a dependent claim.*

Art. 19 claim 5 is amended for nat. stage entry as claim 5 (CURRENTLY AMENDED):

- *Minor rewording is done*
- *Terminology is adapted to claim 1 rewording*
- *The characterization is expressed as two steps for easier understanding*
- *Claim 5 is an independent claim of manufacturing process.*

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Art. 19 claim 6 is amended for nat. stage entry as claim 6 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 5 rewording*
- *Claim 5 is a dependent claim.*

Art. 19 claim 7 is amended for nat. stage entry as claim 7 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 1 rewording*
- *Claim which was multiple-dependent is reduced to a single dependent claim*
- *The general object of the claim is moved to the characterizing part*
- *Claim 7 is an independent claim of use.*

Art. 19 claim 8 is amended for nat. stage entry as claim 8 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 7 rewording*
- *Claim 8 is a dependent claim.*

Art. 19 claim 9 is amended for nat. stage entry as claim 9 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 7 rewording*
- *Claim 9 is a dependent claim.*

Art. 19 claim 10 is amended for nat. stage entry as claim 10 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 7 rewording*
- *Claim 10 is a dependent claim.*

Art. 19 claim 11 is amended for nat. stage entry as claim 11 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 7 rewording*
- *Claim 11 is a dependent claim.*

Art. 19 claim 12 is amended for nat. stage entry as claim 12 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 1 rewording*
- *Claim 12 is an independent claim of complex product.*

Art. 19 claim 13 is amended for nat. stage entry as claim 13 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claims 5 and 12 rewording*
- *Claim 13 is an independent claim of device of implementation (which we consider as not being a multiple dependent claim).*

Art. 19 claim 14 is amended for nat. stage entry as claim 14 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claims 7 and 12 rewording*
- *Claim 14 is an independent claim of device of implementation (which we consider as not being a multiple dependent claim).*

Art. 19 claim 15 is amended for nat. stage entry as claim 15 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 13 rewording*
- *Reference to claim 12 is removed as it is already included in claim 13*
- *Claim 15 is a dependent claim.*

Art. 19 claim 16 is amended for nat. stage entry as claim 16 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 13 rewording*
- *Reference to claim 12 is removed as it is already included in claim 13*
- *Claim 16 is a dependent claim.*

Art. 19 claim 17 is amended for nat. stage entry as claim 17 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 14 rewording*
- *Reference to claim 12 is removed as it is already included in claim 14*
- *Claim 17 is a dependent claim.*

Art. 19 claim 18 is amended for nat. stage entry as claim 18 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 14 rewording*
- *Claim 18 is a dependent claim.*

Art. 19 claim 19 is amended for nat. stage entry as claim 19 (PREVIOUSLY PRESENTED):

- *Claim 19 is a dependent claim.*

Art. 19 claim 20 is amended for nat. stage entry as claim 20 (CURRENTLY AMENDED):

- *Minor rewording is done.*
- *Terminology is adapted to claim 1 rewording*
- *Multiple dependency is reduced to single dependency*
- *Claim 20 is a dependent claim.*

Art. 19 claim 21 is amended for nat. stage entry as claim 21 (PREVIOUSLY PRESENTED):

- *Claim 21 is a dependent claim.*